DOCUMENT RESUME

ED 138 037 FL 007 610

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TITLE	Computerized Instruction in Second-Language Acquisition. Studies in Language Learning, Vol. 1 No. 1, Fall 1975.
INSTITUTION	Illinois Univ., Urbana. Dept. of Linguistics.
PUB DATE	75
NOTE	22p.
AVAILABLE FROM	Linguistics Department, University of Illinois, Urbana, Illinois 61820 ($5.00)
EDRS PRICE	MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS	College Language Programs; College Students; *Computer Assisted Instruction; Computer Oriented Programs; Computer Programs; Evaluation; *French; Higher Education; *Language Instruction; Language Laboratories; Morphology (Languages); *Programed Instruction; Retention; Retention Studies; *Second Language Learning; Syntax; Vocabulary
IDENTIFIERS	PLATO III; PLATO IV

ABSTRACT

This is a report on the use of computerized instruction in some of the elementary French classes at the University of Illinois (Urbana campus). This project was initiated in the fall of 1968. The experiments were carried out on the PLATO III system until January 1973 at which time the PLATO IV system became operational for student use. This research project is to be continued until the computerization of the whole course is completed and a thorough analysis of its value for the students has been made. In Part I of the report, the essential features of a computerized language course are discussed. In Part II, some of the ancillary aspects of computerized instruction are considered. (Author/CFM)

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Studies in Language Learning
Volume I, Number 1, Fall 1975

COMPUTERIZED INSTRUCTION IN SECOND-LANGUAGE ACQUISITION

Fernand Marty M. Keith Myers

INTRODUCTION

This is a report on the use of computerized instruction in some of the elementary French classes at the University of Illinois (Urbana campus). This project was initiated by Professor M. Keith Myers in the fall of 1968; Professor Myers was joined by Professor Fernand Marty in August 1972.

The experiments were carried out on the PLATO III system until January 1973 at which time the PLATO IV system[1] became operational for student use. This research project is to be continued until the computerization of the whole course is completed and a thorough analysis of its value for our students has been made.

This report has two parts. In Part I, we discuss the essential features of a computerized language course; in Part II, we consider some of the ancillary aspects of computerized instruction.

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PART I

In this part, we will attempt to answer three questions:

1. What resources can a computer system offer the language teacher?
2. What benefits can we expect from a computerized course?
3. How can these benefits be obtained?

Resources offered by a computer system

A computer can easily compare a student's answer with a model and tell the student whether his answer is acceptable or not. In

the case of a wrong answer, this immediate feedback is valuable only if some remedial steps designed to prevent the recurrence of the error(s) are available. Moreover, the success of this remedial procedure depends essentially on the competence of the human who prepared the linguistic materials. Unless the materials are presented in a systematic, step-by-step progression and unless all the items are constantly and carefully reviewed, the students will derive little profit from the remedial procedure. It has become apparent that the more a language course adheres to the principles of programmed learning, the easier it is to computerize it and the more successful the computerized version is likely to be.

The principles of programmed learning have been defined in numerous publications. For our part, in the field of language instruction, we published a book in 1962[2] and we summarize these principles in the preface to our present programmed text.[3]

We became interested in computerized instruction when it became apparent in the late 60's that researchers such as those of the Computer-based Education Research Laboratory (University of Illinois) were developing powerful hardware and software systems which had *technological* resources which could greatly facilitate the application of the *pedagogical* principles of programmed learning (individualized instruction, immediate feedback, error analysis, remedial branching, etc.).

The purpose of our research is to compare the results obtained by students working with our programmed text with those obtained by students working with the computerized version of the same linguistic materials.

Like the other sections of elementary French at Urbana, our experimental classes meet four times a week for the usual 50-minute periods. Our students have the option of doing their out-of-class work with the programmed text or with the computerized version.

What benefits do we expect?

1. Higher levels of performance can be attained by increasing the amount of learning per unit of time and/or increasing the amount of study time.

a. If it is true that it is more efficient to work with a computerized course than with a programmed text, the amount of learning per unit of time will increase and a student will reach a given set of objectives in less time (for example, 420 hours instead of 600). Gains of time, no matter how small, would be welcomed by a student already committed to taking a language course; in addition, if these gains of time were to be substantial (30%, for example), we might attract to our language courses student who, at present, are interested in languages but do not have enough time to study.

b. If it is true that certain features of computerized instruction (for example, the constant interaction between the student and the computer) help sustain the student's interest and motivation, help him concentrate, and help keep his fatigue level down, the student will be able to work--of his own accord--for longer spans of time than with a programmed text.

Of course, we hope that both hypotheses will be true--for at least some students--and that this combination will yield considerable improvements in students' performance. If only one hypothesis is true, the gain should be substantially greater than the loss. If both hypotheses are false, the experiment will be a failure--but nothing in the past seven years has indicated that this might be the case.

2. There is also the possibility that computerized instruction can provide a higher level of retention after training has been interrupted. For example, we have indications that students who study with the computer system show a higher degree of retention after the long summer interruption of classes (16 weeks at the University of Illinois) than those who do not. We are planning to measure retention levels in situations such as two years of training followed by a three-year interruption and we expect that the gains in retention will be substantial.

It will be about two years before we can begin to determine whether the expectations described above will be fulfilled. Although our computerized course is operational, there are still some important features such as error analysis and remedial branching (described later) which, as of October 1975, are only partially programmed in

the computer system. (We estimate that writing the computer code just for the error analysis feature still requires more than 2,000 hours of work, and that this task will not be completed until early 1977.) No meaningful measurement of the value of computerized instruction can be made until all the computer programming for all the pedagogical features is completed.

How can these benefits be obtained?

The materials which we are placing on the PLATO IV system come from the 1975 edition of a programmed text which was begun in 1950, tested with thousands of students, and revised many times. Twenty-five years of testing have helped us determine which syntactic, morphological, and lexical items should be taught, which syntactic progression should be followed, and which types of exercises should be used.

When we began the present series of experiments in the fall of 1972, we determined that there were three procedures which might help us computerize our course. We will now explain how each of these procedures has fared.

Procedure 1: *Individualization of the linguistic materials*

In the programmed text, each statement (explanation, guideline) is followed by an exercise which

a. tests the student's understanding of the statement just presented

b. tests the student's recall of some of the statements made in previous units *(cyclic review)*

Preparing the cyclic review for the programmed text was, by far, the most time-consuming part of our work. This is due to several factors:

1. We have to keep track of a large number of items. In our course, there are about 2,000 discrete items which need to be taught and reviewed regularly: about 200 for syntax, 800 for morphology, 1,000 for vocabulary. (Most textbooks for beginning French show a similar inventory; differences, when they occur, are mostly in the amount of vocabulary.) As we progress through the course, the number of items which need to be reviewed increases constantly; halfway

through the course, about 1,000 items have been taught and must be reviewed regularly.

2. In order to keep the number of sentences in each exercise at a reasonable level, we must try to review as many items per sentence as possible. For example, in *"Je ne veux plus lui prêter d'argent."*, we review four syntactic, one morphological and four lexical items. Ideally, we should be able to juggle all the items which are to be reviewed in a unit (up to several hundreds) in such a way that each item is used only once and that we come up with as small a number of sentences as possible. The difficulty is that we are dealing with three distinct categories (syntactic, morphological, lexical) and that these categories do not mesh very well; if we attempt to review the morphological and lexical items evenly, the syntactic review becomes unbalanced. For example, since adjectives can be used in only a very small number of syntactic patterns, an adequate review of the adjectives which we teach in our vocabulary leads to an overreview of these patterns and of the corresponding morphological items (*je suis*, for example).

Under such conditions, the best that one can do is to work with the cyclic review until one feels that no item is overreviewed more than is absolutely necessary and that no item is underreviewed (if the course is used by the type of student for whom and with whom it was developed).

In spite of these unavoidable shortcomings, a cyclic review prepared with great care and much patience can be extremely beneficial; it certainly helps the student maintain a constant level of performance on all the items he has been taught.

The question which we need to answer is whether the computer system can be programmed to remedy, at least partially, the shortcomings of man-created linguistic materials. In other terms, can the computer supply each student with linguistic materials which meet his specific needs? To do so would require three levels of operations:

1. The computer would have to determine the amount of practice a given student needs in order to assimilate a new syntactic pattern. This presents no great difficulty; for example, it can be determined

according to the student's general linguistic ability as measured by the computer from his performance on previous exercises and according to his alertness on this particular day as measured from his last few responses.

2. The computer would have to determine which items are due for review in a particular unit; for example, it should be able to state that in Unit 16 student *N* should review 23 syntactic items (no. 42, 63, 74, etc.), 89 morphological items (no. 249, 263, 306, etc.) and 102 lexical items (no. 1092, 1143, 1229, etc.). This means that we would have to be able to determine for each student the *successive* review intervals which are just right for his optimum learning of each of the 2,000 items. The optimum review interval for each item at a particular time would seem to be an interval which--if increased at all--would cause the student to make an error on that item. But there does not seem to be any way a human or a computer can determine *accurately* what the successive review intervals should be. If a student answers correctly, it may be because:

a. The review interval was just right. In this case, can we assume that this successful review has reinforced the student's knowledge of this item and that the review interval should be increased? If so, what should the new review interval be?

b. The review interval was too short. This would be bad since this would be a case of overreview, but we have no way of knowing by how much the interval was too short.

c. The student made a lucky guess. Any adjustments which we then make to the review interval will be erroneous.

If a student answers incorrectly, it may be because:

a. The review interval was too long. If so, we have no means of knowing by how much.

b. The student was temporarily inattentive. If the computer assumes that the error reflects a lack of knowledge, the adjustment to the review interval will be wrong.

Since the ideal cannot be realized, we would have to be satisfied with an algorithm which, for example, would simply increase or decrease the review interval for each item according to the student's response. Although rudimentary, this level of individualization

would probably provide a better cyclic review than the all-student cyclic review we have in the programmed text.

3. After completing steps 1 and 2, the computer would give *to itself* this kind of command: "For student *N*, exercise 9 of Unit 16 shall consist of 16 sentences. Each sentence shall practice syntax item 127 and shall contain as many items as possible from the following syntactic, morphological and lexical sets: ....." Before we go any further, we must realize that--while this procedure would normally ensure that no item is underreviewed by student *N*--it could not prevent overreview. As we have already seen, it is impossible to assemble hundreds of items coming from three different categories into "sensible" sentences in such a way that each item is used only once.

However, the main difficulty is that individualization of the linguistic materials creates a mathematical monster. With this procedure, each student would review different sets of items for each unit. Let's suppose, for example, that in a given unit student *N* must review this syntactic pattern:

Subject Pronoun + Verb + Determiner + Noun + Adjective + Modifier

J' achète du pain frais tous les matins.

Since the computer cannot predict which morphological and lexical items this particular student will have to review at this particular time, it must be ready to supply him with *any* of *all* the sentences which can be formed with the items taught so far; the number could be:

6 (persons) x 9 (tenses) x 200 (verbs) x 300 (nouns) x 100 (adj.) x 100 (mod.) =
32,400,000,000 (32 *b*illion 400 *m*illion)

Admittedly, some of these sentences--although syntactically acceptable--would have to be rejected because they would not make sense; but, even if we kept only one sentence out of each one hundred thousand, we still would be left with the task of being able to supply 324,000 sentences for that single construction. Since a similar number of sentences would be required for most of the other constructions, the total number of sentences for the course would be in the millions.

Since it is impossible, in practice, to store such an enormous number of sentences and have the computer extract rapidly from the stored set the specific sentences a specific student would require at a specific time, the computer would have to *create* the sentences as they are needed. With this procedure, not a single sentence would need to be stored; the computer would determine which of the items to be reviewed can be combined, and it would output the resulting sentences. In other terms, the computer would perform the same type of work which we have slowly and painstakingly done for the cyclic review of the programmed text, but it would do it instantaneously and on a made-to-order basis.

We can, indeed, program the computer to generate well-formed sentences if we limit the syntax to a small number of elementary rules and the lexicon to a few items. But, at present, no one has a theory which could handle some 200 rules of syntax (some of them extremely complex) and some 800 rules of morphology. Nor can we tag the lexical items in such a way that all the well-formed sentences would be realistic and usable.

Therefore, until we have the theoretical resources necessary to duplicate the linguistic processes of the human mind, we do not see any possibility of individualizing the linguistic materials at the pre-response stage. (Individualizing the remedial branches after an error has been made is an entirely different matter and is discussed later in this report.) For the time being, we have to use the linguistic materials as they are in the programmed text and we must depend on the other two procedures to reach the objectives described in section B.

Procedure 2: Improving the stimulus-response-evaluation-feedback sequence

Let us compare the procedure followed by a student working with the programmed text with that followed by a student working with the computerized version.[4] (We will use the abbreviation PT to refer to the programmed text and the abbreviation CV to refer to the computerized version.)

Step 1: Presentation of the stimulus

PT: The student looks at the stimulus. He uses a paper mask to hide the correct answers printed in the lower half of the page.

CV: The computer presents the stimulus on the screen. The student does not need to use a mask and there is no danger of his inadvertently seeing the model response.

Step 2: Response

PT: The student writes his answer.

CV: The student types his answer. Since the basic purpose of the course is to teach syntax and morphology, the student can--if he wishes--press a key and look at the vocabulary items needed for that response. In addition, if the student is confident that he knows the correct answer and if he believes that typing it would be a waste of his time, he can type a 2-letter code word. He is then shown the correct answer; he can compare it mentally with the answer he would have typed; if his confidence was justified, he can press a key to remove this particular stimulus from the set; if he was overconfident, he can press a key to keep the stimulus in the set and have it presented again at the end of the exercise. This feature was added to our CV because it became obvious during our early experiments that the students resented typing long responses when they felt confident they knew the correct answer.

Step 3: Evaluation

PT: The student lowers his paper mask by one line and compares his response with the model.

CV: The student presses a key to request that the computer evaluate his response.

There are two essential differences in this third step:

a. With the PT, the student must evaluate his answer himself; this self-evaluation, in the case of a long response, can require several seconds. With the CV, this evaluation requires less than half a second on the average.

b. With the PT, even if the student has been trained to perform this self-evaluation carefully, there will be times when he fails to see an error--thereby increasing the probability of recurrence of the error. With the CV, once the computer routine has been properly coded, the evaluation is always accurate.

Step 4: Feedback

Correct response: With the PT, the reinforcement is self-administered. With the CV, the reinforcement is administered by the computer and can vary from a single "*BIEN*" to an elaborate combination of screen animation, color slide, personalized message (written and/or oral), etc.

Wrong response: With the PT, the negative judgment is "self-inflicted" and is an end in itself; since the student has seen the correct response (during the self-evaluation), there is no way he can have another try at solving the problem. With the CV, the negative judgment is transmitted by the computer and can be accompanied by encouraging messages, but the important difference is that this negative judgment can be the beginning of a very fruitful sequence. The basic decision the pedagogical programmer must make at this juncture is whether he himself will set the steps of the sequence or whether he will let the student make his own decisions. After several experiments, we have opted for the following procedure:

a. The student is asked to analyze his erroneous response and to try to correct it *without* asking the computer for help. If the student belongs to the population for whom the course has been written and if he has correctly done all the previous exercises, he should be able to correct most of his errors at this initial stage.

b. If the student cannot correct the error(s) without help, he can ask for any or all of these levels of help: lexical, morphological, syntactic. If this is not sufficient, he can ask for a detailed error analysis; he is then given a list of the type of errors he has made, and the grammar guidelines he has failed to apply are shown to him (slides or written messages). If the student can find and correct his error(s), the stimulus is removed from the set and will not be shown again.

c. If none of the preceding is successful, the student is shown the model response. In this case, the stimulus is saved and presented again at the end of the exercise.

With our procedure, the student works in cooperation and constant interaction with the computer; he is challenged to discover and correct his error(s); the computer can help him solve problems methodically and continue to do so untiringly for as long as the student requires. There are indications that errors which the student discovers and corrects *on his own* are less likely to recur than those he makes with the programmed text.

We expect that the differences we have just discussed: ease of operation (no mask needed), speed (immediate evaluation), accuracy of evaluation, psychological impact (evaluation administered by the computer rather than self-administered, and constant interaction), and especially the procedure which is followed after a wrong response has been made will contribute much toward helping us reach our objectives.

Procedure 3: Delayed remedial branching

We find it useful to draw a distinction between immediate remedial branching and delayed remedial branching.

In the PT, if the student does not understand the nature of the error which he has made, he can immediately go to the *Index* and review the guideline he failed to apply. In the CV, the various levels of help and the error analysis which we provide constitute the immediate remedial branching; since the student reviews the guideline and applies it to the current stimulus, a special review exercise at this juncture does not seem justified.

The delayed remedial branching which we use operates as follows:

In the PT, the student can keep track of his errors by using the *Error Count Sheets*. At regular intervals, he can look at these sheets, determine which items are giving him the most difficulty and do over some or all of the exercises which correspond to these items. Although very useful, this procedure is rather cumbersome. Its main drawback is that, for each item, the student reviews the original practice exercises; therefore, the sentences he works with do not include any of the elements taught since the element he is reviewing was initially presented. With the PT, it would be too expensive to have, for each item, a set of remedial branching exercises from which the student would choose according to the unit he has reached in the course.

In the CV, we have programmed the computer to record each student's performance on each of the 300 items which give the students the most difficulty; the score for each item is computed on no more than the last ten occurrences of that item. At any time, the student can request the computer to show him his scores; for example, upon asking for a list of the items where his score is less than 85, he might see:

Item	Score based on latest present.	Total number of presentations	Description
40	84↑	42	Negative partitive
49	76	36	Pronominal construction expressing reflexive
64	80↑	31	Verb + Infinitive
74	67	28	Adjective + Noun
76	83↑	7	Adjective + Preposition + Infinitive

(The arrow ↑ indicates that the student answered correctly the last time the item was tested.)

If the student then types 74, he is taken to a remedial exercise which reviews item 74 with sentences which he has never done before and which include elements taught since the original presentation of item 74. For example, if the student is now in Unit 18, the review sentences will include elements taught between Unit 13 (where item 74 is taught) and Unit 18. (This feature, too expensive for the PT, does not present a cost problem for the computer system.) Each remedial branching exercise contains four sentences. Since the purpose of this branching is to bring the student to a point where he will perform accurately on a particular item *without* seeing the corresponding "rule", the "rule" is not reviewed before the exercise is begun; it becomes available to the student only if his first two responses are wrong. Of course, when a student begins a remedial branching exercise, we start his score anew for that particular item so that it will show only his performance since the beginning of the branching exercise.

This feature becomes more and more valuable as the student progresses through the course; it is especially useful at the end of the course when all the syntax has been presented and the student does a comprehensive series of exercises designed to bring his performance on all items to a given level.

Summary

We have stated that our purpose is to computerize our programmed text, and we have explained why we believe computerization works best when it is applied to materials which have been prepared according to the principles of programmed learning. We have described the benefits which we expect to obtain from the computerized version, and we have analyzed the procedures through which we hope to reach our objectives.

PART II

In this section, we will consider some of the problems we are encountering and some of the questions which are being raised as we proceed with the computerization of our course.

The need for a computer-operated audio device

PLATO IV terminals can be equipped with an audio device which allows instant random access to any part of a magnetic disc to record the student's voice or play back any of several hundred messages. With this device, oral exercises (dictation, oral transformation, listening comprehension, pronunciation practice, etc.) can have the same flexibility as the written exercises; the device can play instantly whatever sentence is needed by the student. Furthermore, it can be used to increase the effectiveness of the feedback a student receives in written exercises; for example, a correct answer on a particularly difficult sentence could be "rewarded" with a special spoken message, and some errors might be remedied more effectively if the review were presented orally.

While we do not have any firm data about the gains which can be obtained by using an audio device, we have been able to compare classes using the audio device with classes having to use regular tape machines for the audio-oral exercises. There are obvious gains of

time obtained by being able to do all the oral and written work on the same machine and by not having to do all the manipulations which are necessary to replay an item or to search for particular items on a tape recording. There is also an apparent increase in the student's ability to sustain his interest and motivation when he works at a terminal equipped with an audio device.

Should the computerized version be self-contained?

At the beginning of our 1973-1974 experiment, the students did not have a textbook. All the explanations and exercises were available only on the computer system. The advantages of presenting the explanations on the terminal screen are that they can be accompanied by animated graphics or slides, that they can be interlaced with questions which check the student's understanding and--of course--that the student does not need to carry a book and refer to it while working at the terminal.

However, we found that there were considerable drawbacks:

a. With a book, a student can go rapidly and easily from page to page, compare explanations, review, underline, write notes in the margins, etc.

b. The terminal screen on the PLATO IV system displays 64 characters across and 32 lines vertically. This is not enough for many of the charts which are needed for language instruction, charts which most of the time lose their effectiveness when they are subdivided.

c. Sometimes it is difficult to understand a concept unless the whole paragraph where it is expressed is in front of our eyes; on PLATO IV, long paragraphs must be split into several sections and this may interfere with comprehension.

For these reasons (and possibly others), the students generally reported that reading explanations on the computer screen was more tiring than reading them on printed pages and that they had difficulty understanding and retaining material. About halfway through the course, these objections became so strong that we had to distribute hand-outs with the printed text of the explanations.

Thus, except for the explanations which require the use of the audio device, this group of students showed a strong preference for studying each explanation in a book and then doing the corresponding exercise on the computer system.

We are planning to investigate this point further and it is possible that, in the final form of this computerized course, the students will have a choice. Each time they start working with the computer, they will be asked whether they prefer to use their books or have the explanations shown on the screen.

The time factor in the utilization of computerized instruction

If a gain of time in reaching a given set of objectives is one of the benefits to be expected from computerized instruction, then the efficient use of time while using a terminal becomes crucial.

In language study, a student may have to type sentences of over 100 characters. If upon completing a sentence, a student realizes that he has made an error, he should be able to correct any individual word or add words without having to retype the rest of the sentence.

The computer should respond rapidly. For example, in our language exercises, less than half a second on the average elapses between the moment the student presses a key to request the evaluation of his answer and the appearance of the computer's evaluation on the screen. A delay of five seconds, by itself, may seem insignificant but--since our language students have to make frequent requests--the time gained by having a delay of only half a second becomes considerable. Moreover, long delays--especially for the evaluation of the student's response--cause a drop of attention and interest.

The efficient use of time also requires that computer terminals be conveniently situated so that they can be reached rapidly from any part of the campus and that each student have immediate access to the terminal for which he has been scheduled; this means that, if a student has reserved a terminal from 9 to 11, the terminal should become available at 9, not 9:15. In view of the present high cost of terminals and communication lines between terminals and the central

computer, it is not possible to install enough terminals so that *any* student at *any* time could be practically certain of having immediate access to a terminal without a prior reservation. The fact that a student must schedule his computer work for particular times is certainly a negative factor; with a book, he can study anywhere at any time. Obviously, students will become reluctant to use computerized instruction if, in order to gain access to a terminal, they have to waste more time than they could possibly save by using the system. For the success of computerized instruction, it is essential that the cost of terminals be considerably reduced and that the students have far greater freedom in their access to terminals. (The suggestion that the students use the terminals as a group at times scheduled for their regular classes is unacceptable for beginning language classes; as it is, language students already do not have enough oral practice with a live teacher and we certainly do not want to replace some of that teacher-directed work with computerized instruction. To be of value to us, computerized instruction must be in addition to, not instead of, our regular classes.)

The computer system should be thoroughly reliable. This means that:

a. unplanned interruptions of service should occur only rarely (certainly no more than once a week). Such interruptions are particularly annoying since they often involve the irretrievable loss of data necessary for remedial branching.

b. interruptions, if they do occur, should be short, and the students should be immediately informed of the probable duration of the interruption.

Finally, conditions which cause distraction and waste of time should be eliminated: high noise level (by machines and people), unpleasant heat and humidity levels, poor seating conditions, poor lighting, etc.

Typing skill and computerized instruction

Unless a language student can type well enough to be able to concentrate his whole attention on the subject he is learning, he will not receive the full benefits of computerized instruction.

A language student who has to search for every letter on the keyboard and who is unable or unwilling to improve his typing is clearly wasting his time at a computer terminal. But this does not mean that the student should have the skill of a professional typist; indeed, a speed as low as 80 characters per minute (even with only two fingers!) is quite sufficient. (On the PLATO IV system, it is possible to communicate with the computer without typing simply by touching various areas of the screen, but this technique is useful only for some simple types of exercises.)

A question which merits serious investigation is whether learning a second language through typewriting is as effective as through handwriting. The kinetic memories involved are quite different and may vary considerably in their effectiveness. In any case, a device which could read handwriting (even if it could recognize only well-formed letters) would be of great value.

Conflicting views about the use of computerized instruction

Let us assume that the experiments we are conducting now with *volunteer* students prove that computerized instruction allows the student to reach levels of performance substantially higher than those they would reach with the programmed text. Should we then decide that all the students taking a French course should study with the computer? If so, should we do this by requiring attendance at a computer terminal a specified number of hours per week or by making the course materials available only on the computer system? Should we give all the examinations on the computer?

A strong case could be made for the required use of computerized instruction. It might be argued that a teacher's foremost duty is to bring each of his students to the highest possible level of performance and that in order to do so it is his responsibility to choose the "best" course objectives, the "best" textbook, the "best" classroom techniques, and the "best" medium of study for out-of-class work.

Objections would come from students who cannot type and who would claim that the ability to type should not be a prerequisite for a French course, from students who claim that they are afraid of machines, from students who believe that computers dehumanize the educational

process, from students who--in the name of privacy--do not want a teacher to be able to gather data about their studying, etc.

Our own experience indicates that this type of coercion usually fails; the students who are compelled to use a method or technique against their will--whatever the cause of their hostility may be--show such a lack of application that the poor results they obtain prove to their satisfaction that their hostility was justified and that they would have performed better had they been left free to choose their own medium of study.

Some teachers (for pedagogical reasons) and some administrators (for financial reasons) might adopt an opposite point of view. They might think that access to the computer system should be a privilege and should be restricted to the students who show clear evidence that they intend to reach their own highest possible level of performance. Why, they might say, allow a student to tie up a terminal when his ambition does not go any higher than doing the very minimum amount of work needed to pass the course?

Our own preference is to continue to make the use of the computer optional. We consider that PLATO IV is an educational resource similar to the library. We point out to our students the potential benefits they can derive from the computerized version of the course and we stress that these benefits can reach their full value only when the computer is used regularly. We leave the students totally free to use the computerized version as they wish: they can skip forward, redo any exercise, select the type of help which they find most beneficial, etc. We are confident that the students themselves can assess the value of computerized instruction accurately; if--*on their own*--they find that it does indeed help them learn, its success will be assured.

We also believe that, in language courses, the computer should not be used to give examinations that count toward the student's grade in the course. There is the inherent danger that a student who does not receive the grade he thinks he deserves will blame the computer and say that it made a mistake in processing some of his answers or in computing his grade. Moreover, some students who feel quite at ease when they do practice work with the computer become very nervous if an examination is given. This, inevitably, leads to negative

attitudes toward computerized instruction in general and toward the course in particular.

In short, we believe that the success of computerized instruction depends on the student's regarding the computer system not as a tyrannical taskmaster, but rather as a tireless and resourceful tutor always ready to help when needed.

Oral free expression

In a typical language course, the student is expected to do one to two hours of out-of-class work for each hour spent with the teacher. In class, the teacher usually tries to have some *free* oral expression practice in addition to the *directed* expression practice (only one response acceptable for each stimulus) through which he teaches syntax and morphology. With that system and with classes of some 20 students, it is difficult to give each student more than 2 minutes a week for truly free oral practice and there are considerable differences between the levels (accuracy and fluency) obtained in *directed* expression and *free* expression. We tried to determine whether this situation could be improved with the use of programmed materials.

One of the basic principles of programmed learning theory is that the materials are tested repeatedly until the sequencing of the items to be taught, the explanations and the exercises are so clear that no outside help is needed for their use; that is, programmed materials should allow total self-instruction.

After the publication of the 1965 version of our programmed materials, we tried to have the students work with these materials entirely on their own (total self-instruction) so that all their time with the teacher would be spent on *free* expression. The class was divided into groups of three or four students for the free expression practice and each student was given ten minutes of practice per week. To facilitate the self-instruction work, we installed high-fidelity audio equipment and the students used soundproofed rooms which allowed loudspeaker listening (rather than the more tiring headphone listening).

This experiment was performed several times with the programmed text and once with the computerized version. Each time, it failed on two counts:

a. The vast majority of the students (see next section for exceptional students) did not do as well with the programmed materials as they would have done if some classtime had been spent on them. Whether we use the programmed text or the computerized version, total self-instruction results in a loss.

b. In free expression, there was a little progress in fluency, but it was more than offset by a loss in accuracy (probably caused by the failure of {a}). Attaining satisfactory levels of accuracy and fluency in free expression does not seem possible solely through classroom practice.

For the time being, there does not seem any way of simplifying or accelerating the process of acquiring satisfactory levels in free expression. We will have to continue to depend on a balanced combination of directed expression and free expression in class and much free expression practice obtained through the use of exchange students, tape correspondence, sojourns in the foreign country, etc.

Computerized instruction and the exceptional student

By exceptional student, we mean the type of student who is highly-gifted for language study, highly motivated and self-disciplined. This student finds the usual language class too slow and much of his time there is wasted.

Language departments rarely give the exceptional student the attention he deserves. Such students are too few in number to warrant the setting up of special sections.

We have begun an experiment designed to determine whether a combination of computerized instruction and teacher-directed activities could make small sections (for example, four students) financially viable. The group we have this year meets only one hour per week with the teacher. If this should prove adequate, a single teacher could carry four such groups at four different levels, and this combination could be considered a teaching load equal to one regular course.

CONCLUSION

Many language teachers today have not had any training in applied linguistics, have not heard of programmed learning, and feel ill at ease--if not downright hostile--when educational technology is discussed. What chance is there that they will show any interest in a method of instruction which combines these three fields?

Those of us who work on this project would be pleased to try to show that computerized instruction can have its place in the humanities and that it does hold much promise for the rejuvenation of second-language acquisition. We can meet here at the University of Illinois with anyone who is interested in this project and would like to follow its development.

Notes

1. For a description of the PLATO systems, see Elisabeth R. Lyman, *Plato Highlights*, July 1975 and David V. Meller, *Using Plato IV*, July 1974 (CERL, University of Illinois).

2. Fernand Marty, *Programming a Basic Foreign Language Course*, 1962, out of print, reviewed by John Carroll in *Contemporary Psychology*, November 1962.

3. Fernand Marty, *Elements for Self-Expression in French* (Champaign, Illinois: Audio-Visual Publications, 1975), p. xii-xiii.

4. Most of the computer programming for this course has been done by Robert Ariew (now at Pennsylvania State University), Robert Hart (University of Illinois) and Susan Campanini (University of Illinois).